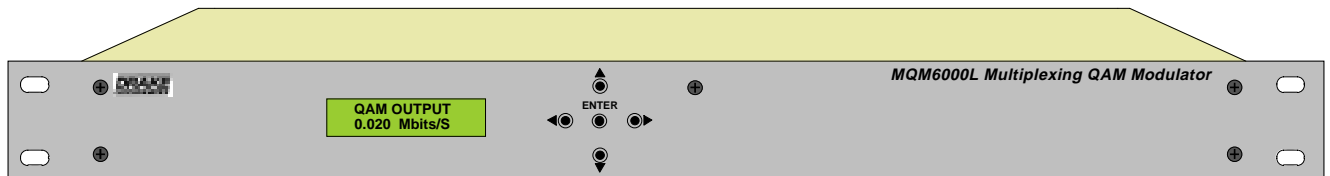




MQM6000L Multiplexing QAM Modulator

Instruction Manual



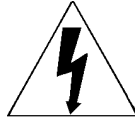
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2 Caution Statements

WARNING: TO PREVENT FIRE OR ELECTRICAL SHOCK DO NOT EXPOSE TO RAIN OR MOISTURE



A product and cart combination should be moved with care. Quick stops, excessive force and uneven surfaces may cause the product and cart combination to overturn.



The lightning flash with arrow head symbol, within an equilateral triangle, is intended to alert the user to the presence of uninsulated "dangerous voltage" within the product's enclosure that may be of sufficient magnitude to constitute a risk of electric shock to persons.



The exclamation point within an equilateral triangle is intended to alert the user to the presence of important operating and maintenance (servicing) instructions in the literature accompanying the product.

WARNING: TO REDUCE THE RISK OF FIRE OR ELECTRIC SHOCK, DO NOT EXPOSE THIS PRODUCT TO RAIN OR MOISTURE.
DO NOT OPEN THE CABINET, REFER SERVICING TO QUALIFIED PERSONNEL ONLY.

CAUTION: TO PREVENT ELECTRIC SHOCK, DO NOT USE THIS (POLARIZED) PLUG WITH AN EXTENSION CORD RECEPTACLE OR OTHER OUTLET UNLESS THE BLADES CAN BE FULLY INSERTED TO PREVENT BLADE EXPOSURE.

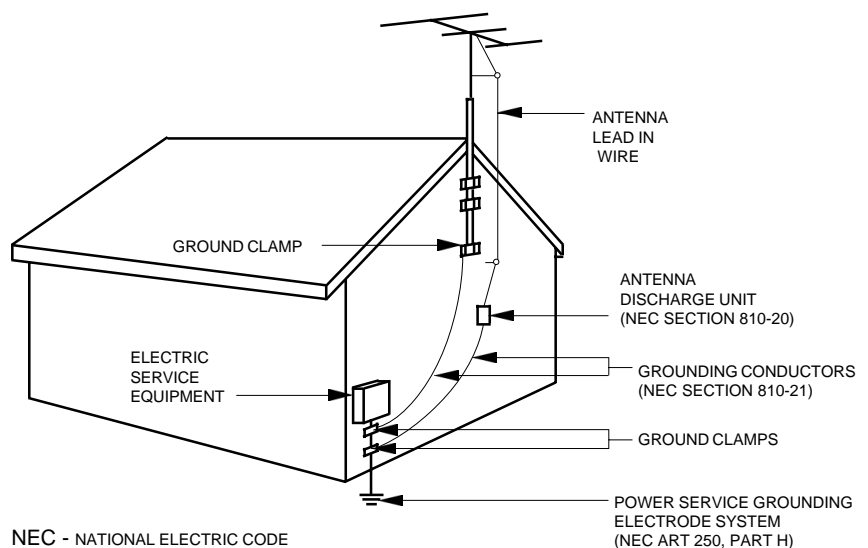
ATTENTION: POUR PREVENIR LES CHOCS ELECTRIQUES, NE PAS UTILISER CETTE FICHE POLARISEE AVEC UN PROLONGATEUR, UNE PRISE DE COURANT OU UNE AUTRE SORTIE DE COURANT, SAUF SI LES LAMES PEUVENT ETRE INSEREES A FOND SANS EN LAISSER AUCUNE PARTIE A DECOUVERT.

- 1. Read Instructions**—All the safety and operating instructions should be read before the product is operated.
- 2. Retain Instructions**—The safety and operating instructions should be retained for future reference.
- 3. Heed Warnings**—All warnings on the product and in the operating instructions should be adhered to.
- 4. Follow Instructions**—All operating and use instructions should be followed.
- 5. Cleaning**—Unplug this product from the wall outlet before cleaning. Do not use liquid cleaners or aerosol cleansers. Use a damp cloth for cleaning.
- 6. Attachments**—Do not use attachments that are not recommended by the product manufacturer as they may cause hazards.
- 7. Water and Moisture**—Do not use this product near water—for example, near a bathtub, wash bowl, kitchen sink or laundry tub; in a wet basement; or near a swimming pool; and the like.
- 8. Accessories**—Do not place this product on an unstable cart, stand, tripod, bracket, or table. The product may fall, causing serious injury to a child or adult, and serious damage to the product. Use only with a cart, stand, tripod, bracket, or table recommended by the manufacturer, or sold with the product. Any mounting of the product should follow the manufacturer's instructions, and should use a mounting accessory recommended by the manufacturer.
- 9. A product and cart combination** should be moved with care. Quick stops, excessive force, and uneven surfaces may cause the product and cart combination to overturn.
- 10. Ventilation**—Slots and openings in the cabinet are provided for ventilation and to ensure reliable operation of the product and to protect it from overheating, and these openings must not be blocked or covered. The openings should never be blocked by placing the product on a bed, sofa, rug, or similar surface. This product should not be placed in a built-in installation such as bookcase or rack unless proper ventilation is provided or the manufacturer's instructions have been adhered to.
- 11. Power Sources**—This product should be operated only from the type of power source indicated on the marking label. If you are not sure of the type of power supplied to your home, consult your product dealer or local power company. For products intended to operate from battery power, or other sources, refer to the operating instructions.
- 12. Grounding or Polarization**—This product may be equipped with a polarized alternating-current line plug (a plug having one blade wider than the other). This plug will fit into the power outlet only one way. This is a safety feature. If you are unable to insert the plug fully into the outlet, try reversing the plug. If the plug should still fail to fit, contact your electrician to replace your obsolete outlet. Do not defeat the safety purpose of the polarized plug.
Alternate Warnings—If this product is equipped with a three-wire grounding-type plug, a plug having a third (grounding) pin, the plug will only fit into a grounding-type power outlet. This is a safety feature. If you are unable to insert the plug into the outlet, contact your electrician to replace your obsolete outlet. Do not defeat the safety purpose of the grounding-type plug.
- 12 a. Mise à la terre ou Polarisation**—Cet appareil est équipé avec un cordon d'alimentation à trois fils. Il est à brancher sur une prise ayant un connecteur à la terre. Assurez-vous que la connection à la terre ne manque pas.
- 13. Power-Cord Protection**—Power-supply cords should be routed so that they are not likely to be walked on or pinched by items placed upon or against them, paying particular attention to cords at plugs, convenience receptacles, and the point where they exit from the product.

- 14. Outdoor Antenna Grounding**—If an outside antenna or cable system is connected to the product, be sure the antenna or cable system is grounded so as to provide some protection against voltage surges and built-up static charges. Article 810 of the National Electrical Code, ANSI/NFPA 70, provides information with regard to proper grounding of the mast and supporting structure, grounding of the lead-in wire to an antenna discharge unit, size of grounding conductors, location of antenna-discharge unit, connection to grounding electrodes, and requirements for the grounding electrode. See Figure A.
- 15. Lightning**—For added protection for this product during a lightning storm, or when it is left unattended and unused for long periods of time, unplug it from the wall outlet and disconnect the antenna or cable system. This will prevent damage to the product due to lightning and power-line surges.
- 16. Power Lines**—An outside antenna system should not be located in the vicinity of overhead power lines, other electric light or power circuits, where it can fall into such power lines or circuits. When installing an outside antenna system, extreme care should be taken to keep from touching such power lines or circuits as contact with them may be fatal.
- 17. Overloading**—Do not overload wall outlets, extension cords, or integral convenience receptacles as this can result in a risk of fire or electric shock.
- 18. Object and Liquid Entry**—Never push objects of any kind into this product through openings as they may touch dangerous voltage points or short-out parts that could result in a fire or electric shock. Never spill liquid of any kind on the product.
- 19. Servicing**—Do not attempt to service this product yourself as opening or removing covers may expose you to dangerous voltage or other hazards. Refer all servicing to qualified service personnel.
- 20. Damage Requiring Service**—Unplug this product from the wall outlet and refer servicing to qualified service personnel under the following conditions:
 - a. When the power-supply cord or plug is damaged,
 - b. If liquid has been spilled, or objects have fallen into the product,
 - c. If the product has been exposed to rain or water,
 - d. If the product does not operate normally by following the operating instructions. Adjust only those controls that are covered by the operating instructions as an improper adjustment of other controls may result in damage and will often require extensive work by a qualified technician to restore the product to its normal operation,
 - e. If the product has been dropped or damaged in any way, and
 - f. When the product exhibits a distinct change in performance—this indicates a need for service.
- 21. Replacement Parts**—When replacement parts are required, be sure the service technician has used replacement parts specified by the manufacturer or have the same characteristics as the original part. Unauthorized substitutes may result in fire, electric shock or other hazards.
- 22. Safety Check**—Upon completion of any service or repairs to this product, ask the service technician to perform safety checks to determine that the product is in proper operating condition.
- 23. Wall or Ceiling Mounting**—The product should be mounted to a wall or ceiling only as recommended by the manufacturer.
- 24. Heat**—The product should be situated away from heat sources such as radiators, heat registers, stoves, or other products (including amplifiers) that produce heat.

NOTE TO CATV SYSTEM INSTALLERS:
THIS REMINDER IS PROVIDED TO CALL THE CATV SYSTEM INSTALLER'S ATTENTION TO ARTICLE 820 - 40 OF THE NEC THAT PROVIDES GUIDELINES FOR PROPER GROUNDING AND, IN PARTICULAR, SPECIFIES THAT THE CABLE GROUND SHALL BE CONNECTED TO THE GROUNDING SYSTEM OF THE BUILDING, AS CLOSE TO THE POINT OF CABLE ENTRY AS PRACTICAL.

Figure A
Example of antenna grounding as per National Electrical Code, ANSI/NFPA 70



4 Table of Contents / Specifications

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SPECIFICATIONS

ASI INPUTS

Six Inputs Programs

270 MHz clock rate, 40 Mbps maximum TS rate at each input. MPTS or SPTS

MULTIPLEXING and PROGRAM FILTER

One SPTS may be selected from each input. The selected programs will be multiplexed as long as the data rate of the resulting MPTS does not exceed the output QAM channel capacity.

NULL PACKET PROCESSING:

Fixed output clock mode

QAM MODULATOR

Modulation Modes:

16QAM, 32QAM, 64QAM, 128QAM, 256QAM, 512QAM or 1024QAM. (See page 9 for all available combinations of QAM modes and FEC.)

Symbol Rate:

1 Ms/s to 7 Ms/s.

FEC:

ITUA (DVB) or ITUB (DigiCipher II).

I/Q Phase Error:

Less than 1 degree.

Carrier Suppression:

45 dB.

Channel Amplitude Error:

Less than 1 dB.

MER:

Greater than 38 dB with blind equalizer.

UPCONVERTER RF OUTPUT

Output Frequency Range:

54 MHz to 1002 MHz.

Channel Plan:

Std. CATV, HRC, IRC, or Broadcast

FCC offsets:

Automatic, +12.5 or +25 kHz

Frequency Stability:

± 5 ppm.

Maximum Output Level:

+ 40 dBmV minimum, adjustable downward.

Output Level Accuracy:

± 1 dB.

Output Impedance:

75 Ohms with return loss better than 14 dB (within output filter passband).

Spurious Outputs:

-60 dBc from 40 MHz to 1000 MHz.

Broadband Noise:

-75 dBc

Phase Noise:

-101 dBc @ 10 kHz offset

RS232 CONTROL

Data Link:

2400, 4800, 9600, or 19,200 baud interface via serial cable.

RS232 Input:

DB-9 connector for connection to modem or PC.

RS232 Output:

DB-9 connector for connection to additional transcoders.

GENERAL

Power:

90 - 132 VAC/ 60 Hz, 15 W maximum.

Weight:

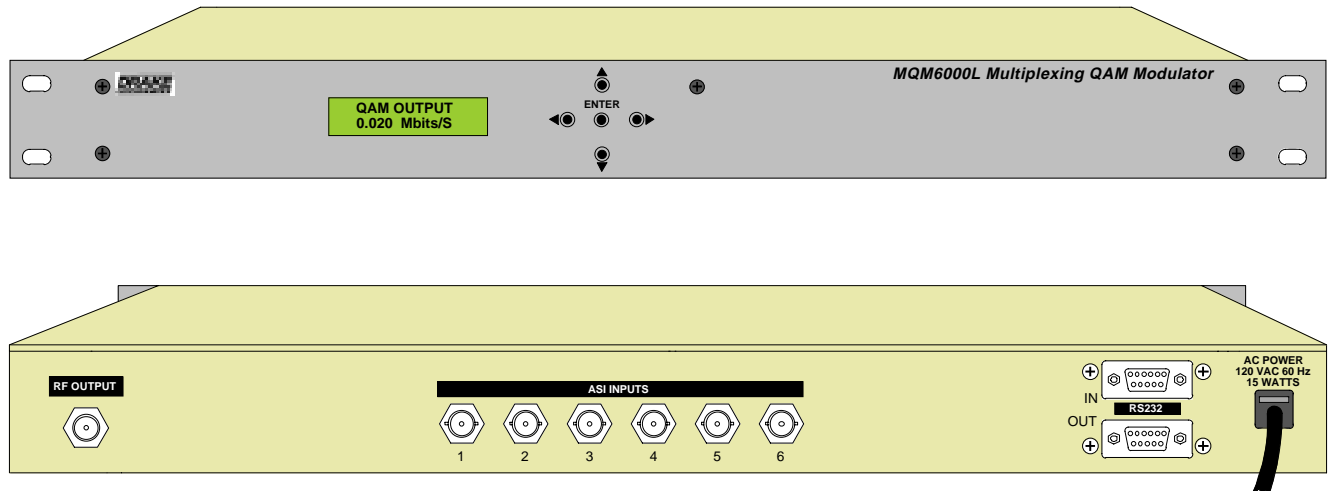
7 pounds

Size:

19" W x 1.75" H x 11.5" D.

Operating Temperature:

0 degrees C to + 50 degrees C



GENERAL DESCRIPTION

The R.L. Drake model MQM6000L is a professional quality, digital headend transcoder that receives up to six multiprogram transport streams via six BNC, ASI inputs. When six streams are input, the MQM6000L then multiplexes one program from each input and applies the result to the QAM modulator and up converter for output.

A program filter is provided to allow selection of the one desired program from each input. Other programs in the incoming streams are dropped.

The MQM6000L offers a +40 dBmV output upconverter with phase noise reduced to a level that is compatible with QAM modes up through 1024QAM.

The MQM6000L can be used with the Drake Digital Headend Remote Control Software, version to be announced, for setting up the program filtering, remote controlling, or remote monitoring of operating parameters. This program can also be used to download new firmware into the unit if that ever becomes desirable.

The MQM6000L operates in a fixed output clock mode and processes null packets when required to maintain the set fixed clock rate. PCR correction is included.

PROGRAM FILTERING

A 'Select Program' function is provided to allow the operator to select which MPEG program present on each of the six input streams is to be included in the output multiplex.

PSIP OPTIONS

The MQM6000L can be set to process PSIP information from all six sources and rewrite tables containing combined PSIP information, or in cases where the off-air broadcast channels may not be transmitting some or all of the tables, it can be set to ignore and discard the PSIP tables completely, or it can be set to generate MGT and VCT tables without EIT tables. Null packet processing is applied as necessary to keep the output data rate at the desired setting. PCR correction is performed when necessary.

OUTPUT

The RF output is always QAM regardless of whether the input is VSB or QAM and the built-in agile upconverter provides +40 dBmV output.

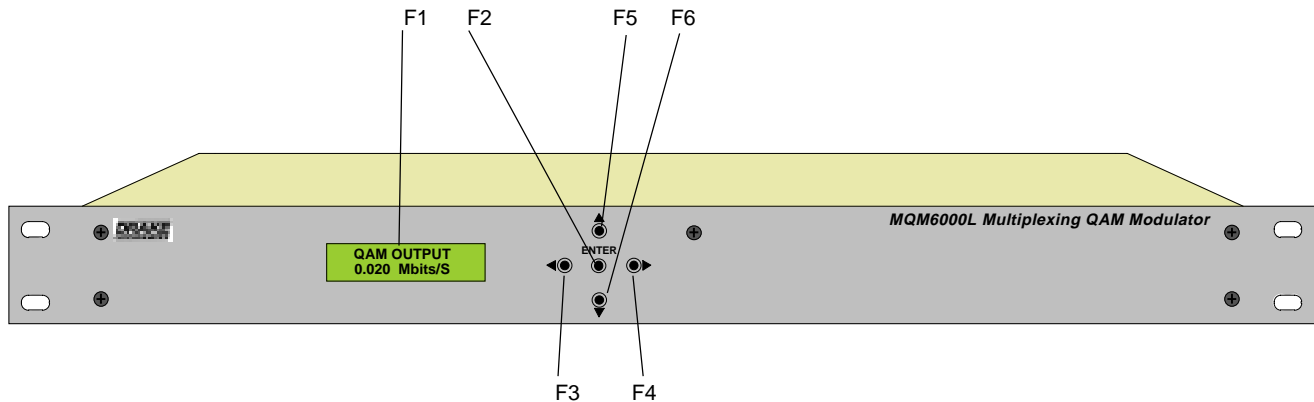
6 Installation & Mounting / Front Panel Controls

INSTALLATION AND MOUNTING NOTES

This equipment is designed to be installed in a standard 19" rack. When the unit is mounted above or below other rack mounted equipment, a 1U space should be left between the unit and the other equipment to allow ambient air flow between the units.

Connect the AC line cord to an appropriate source of 120 volt, 50/60 Hz AC power. The MQM6000Lis always on once the AC power cord is connected to its power source.

FRONT PANEL CONTROLS



F1, LCD Display – This display presents the selected menu screen and the parameter settings. The backlight in the display is on when power is applied.

When not in adjust mode the QAM output symbol rate in Mbits per second is displayed.

Pressing the down button shows the buffer status as a percentage of its maximum capacity. The left percentage represents the current buffer status and the right number represents the maximum percentage of buffer capacity that was reached since the unit was last programmed. If either of these numbers reaches 100%, it is probable that too much data is being processed which will likely result in missed frames, video or audio breakup, or other anomalies in the output signal.

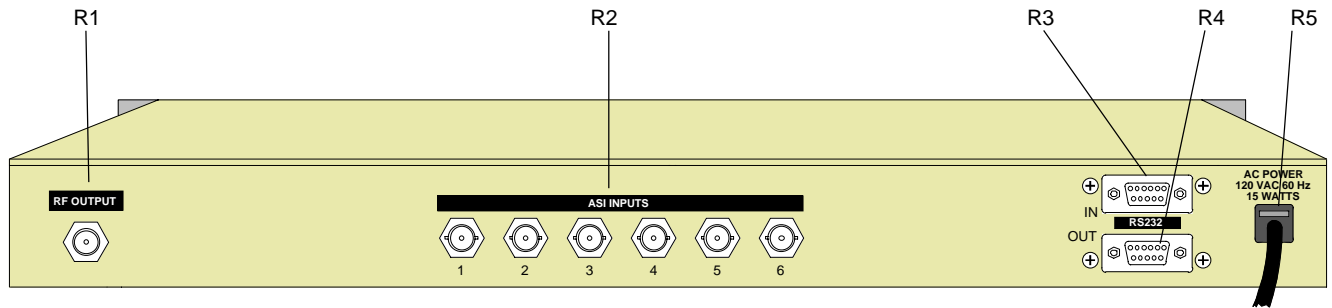
Repeatedly pressing the down button will toggle back and forth between the buffer status screen and the QAM output symbol rate screen.

Pressing the up button causes the display to show the firmware version number. Repeatedly pressing the up button will cause the display to toggle back and forth between the firmware version number and either the QAM output symbol rate screen or the buffer status screen, whichever one is selected with the down button.

F2, ENTER button – Use the ENTER button to enter the adjust mode or to save and load a new setting or settings after adjustment. Hold for 2 seconds until the bottom line of the display starts to flash to enter the adjust mode. After entering the adjust mode, momentarily pressing the ENTER button again will load and save any settings that may have been changed using the F5 & F6 buttons.

F3 & F4, ◀ Left and ▶ Right Buttons – Use the left and right arrow buttons to navigate from screen to screen to view a parameter setting. These buttons are operational in the view mode or the adjust mode. Using only these buttons will not change any parameter settings. After a short period of button inactivity, the default display will be returned.

F5 & F6, ▲ Up and ▼ Down Buttons – Use the up and down arrow buttons to change the value of a viewed parameter setting. The unit must be in the adjust mode with the display flashing in order for these buttons to become active for changing a parameter setting. If the unit is not in the adjust mode, pressing the up button will display the firmware version number or pressing the down button will display the output QAM symbol rate.



R1, RF OUTPUT – This type "F" connector is the high level (+40 dBmV), 54 to 1002 MHz, output from the MQM6000L upconverter section.

R2, ASI INPUTS 1 through 6 - These six BNC type connectors each accept multiprogram ASI format MPEG2 transport stream inputs.

R3, RS232 IN - Connection to a PC or modem for use with remote control / monitoring program or for firmware download.

R4, RS232 OUT - Loop to another MQM or DQT.

R5, AC Line Cord – For connection to the nominal 120 VAC power source. This unit is designed for use in countries with 120 VAC power standards but the power supply will accept an input voltage range of 90 VAC minimum to 260 VAC maximum with a power line frequency of either 50 or 60 Hz. The maximum power consumption is 15 watts.

8 Setup and Programming

Programming and viewing of the various setup and operating parameters is accomplished using the front panel back lit, two line, sixteen character wide LCD along with the 4 arrow buttons and the ENTER button. The name of the parameter is on the top line of the display and the setting value is on the bottom line.

To observe a certain parameter setting without intending to change its value, just use the left and right arrow buttons to navigate through the menus shown in the list. The current setting for each parameter is shown on the bottom line of the display. Note that depending upon certain settings, some screens are not needed and will be skipped.

To make a change in the displayed parameter and its setting and if this is the initial setup, you will want to enter the 'adjust' mode. To do this, press the ENTER button that is located in the center of the four arrow buttons and hold in for several seconds until the display begins to flash. After you are in the adjust mode (bottom line of screen flashing) use the left and right arrows to navigate among screens and use the up and down arrows to change the parameter setting. When ENTER is pressed, the new settings will be loaded and stored and the unit will exit the 'adjust' mode. You may wish to not press ENTER until you have gone through all screens and settings and then press ENTER to save and load all changes in one step OR you can store just one or several parameters at a time and reenter adjust mode to set the next. Either method is acceptable.

<u>Menu Item</u>	<u>Parameter Setting Choices</u>
<i>Top display line.</i>	<i>Second display line.</i>
<i>Use left/right arrows to navigate.</i>	<i>Must be in adjust mode to change using up/down arrows.</i>

UNIT ID: # (0 thru 63)

RS232 BAUDRATE: 2400
4800
9600
19,200

MPEG PROGRAMS: DEFAULT
SELECT PROGRAMS

QAM MODE: QAM-16A
QAM-32A
QAM-64A
QAM-128A
QAM-256A
QAM-512A
QAM-1024A
QAM-64B
QAM-256B
QAM-1024B

GRAY ENCODING: *(This menu item only appears if QAM modes QAM-16A thru QAM-1024A are selected.)*
DVB
DAVIC

QAM SYMRATE: PRESET
MANUAL

QAM SYMRATE: x.xxxx MSym/Sec *(only in manual)*

OUTPUT FORMAT: NORMAL
CW
STANDBY
PRBS 15
PRBS 15M
PRBS 24
PRBS 23M

OUTPUT CHANMAP: BROADCAST
CATV
IRC
HRC

OUTPUT CHANNEL: 2 thru 69 (broadcast)
2 thru 158 (CATV)
1 thru 158 (IRC & HRC)

RF LEVEL: xx.x dBmV (+30 to +42 dBmV)

UNIT ID: Select the desired unit identification number when connecting the 'RS232 IN' connector to a PC or modem for remote control using 'Drake Remote Control Software'. Numbers 1 thru 63 may be used. If zero (0) is selected, the PC will ignore the unit.

RS232 BAUD RATE: This setting determines the baud rate at which the MQM6000L communicates with the remote PC. Settings available are 2400, 4800, 9600 and 19,200. All units 'daisy chained' to the remote PC or modem must be set to the same baud rate.

MPEG PROGRAMS: This menu provides selections to determine which programs are multiplexed to form the new multiprogram transport stream output that will be supplied to the QAM modulator section.

Choose the DEFAULT setting to multiplex the lowest numbered (or only) MPEG program from each of the six ASI inputs.

Choose the SELECT PROGRAMS setting to allow the operator to pick which program (or no program) from each of the six ASI inputs is to be included in the output multiplex. Only one program from each of the six inputs can be selected. This selection must be made using a PC connected to the RS232 IN port and running the 'Drake Digital Headend Remote Control Software' program.

It is the operator's responsibility to be sure that the total data rate of these programs does not exceed the maximum data rate for the output QAM mode that will be used. If the total input rate is too large, some programs will have to be dropped from the multiplex.

QAM MODE: This menu allows the user to set the modulation type for the output. Choices range from QAM-16A through QAM-1024B. 'A' suffixes indicate DVB compliant FEC and the B suffixes indicate DigiCipher II FEC encoding. Note that the output QAM mode usually must be QAM-256. For CATV systems using DigiCipher II, select the QAM-256B mode. For DISH Network QAM distribution or other DVB systems using DVB set tops, choose the QAM-256A mode.

GRAY ENCODING: This menu is only available when QAM modes QAM-16A through QAM-1024A, are selected. The choices are DVB and DAVIC. DVB is normally used for video.

QAM SYMRATE: This menu allows selection of the output QAM baudrate or symbol rate. Set as required by the set top box.

If PRESET is selected, the symbol rate will be set according to the QAM mode that has been selected. If MANUAL is selected, pressing the right or left arrow buttons will allow selection of symrates from 1.000 thru 7.000 MSym/Sec.

OUTPUT FORMAT: For normal operation, select NORMAL.

For system level set up, choose CW to provide a CW carrier at the center frequency of the output channel for use in leveling a system when a QAM power meter is not available. In the CW mode, the CW carrier can be measured on a spectrum analyzer without a need to apply a bandwidth correction or it can be measured with an analog meter tuned to channel center. The CW power measured will equal the channel QAM power when the modulator is returned to NORMAL output mode. Usually

QAM signals are normally set 5 dB to 10 dB below analog NTSC channels when balancing a system.

PRBS menu entries are used for testing purposes only and should normally not be selected by the user.

OUTPUT CHANMAP, OUTPUT CHANNEL: Select the desired EIA CATV channel output using these two menus.

RF LEVEL: Select the desired RF output signal level. The available range is between +30 dBmV and +42 dBmV, selectable in 0.5 dB steps. The output accuracy is ± 1 dB.

OPERATION

MULTIPLEXING SIX INPUTS

To use the MQM6000L to multiplex six inputs, proceed as follows:

- 1) Connect the six MPEG2 SPTS or MPTS signal sources to the six ASI input connectors on the rear of the MQM6000L.
- 2) Plug the power cord from the unit into the power source.
- 3) Follow the instructions in the previous programming section to select the desired MPEG programs. (See the previous section for details.)
- 4) In the OUTPUT CHANMAP menu, select the output channel format (BROADCAST, CATV, HRC, or IRC).
- 5) From the OUTPUT CHANNEL menu, select the desired output channel number.
- 6) From the RF LEVEL menu, select the desired output level. Depending on the diagnostic equipment available, you may want to select CW from the OUTPUT FORMAT menu to balance the output with the outputs of the other inputs to the cable system. When finished balancing the system, select NORMAL from this menu.
- 7) From the QAM MODE menu, set the QAM modulator to QAM-256B for use in a DigiCipher II environment. If DVB, use QAM-256A instead.
- 8) In the QAM SYMRATE menu, select PRESET.
- 9) Set the OUTPUT FORMAT to NORMAL if you have not already done so.

ADDITIONAL INFORMATION

SET TOP BOX MAPPING

The output stream of the MQM6000L will contain programs xx - 1 thru 6 where xx is the RF output channel and 1 thru 6 are the MPEG program numbers assigned that correspond to the ASI inputs 1 thru 6.

STANDBY MODE

The MQM6000L has a standby output mode which turns off the RF output. This can be used when it is desirable to temporarily disable the output without unplugging the AC line cord. Select STANDBY in the OUTPUT FORMAT menu.

OVER TEMPERATURE SENSOR

Temperature monitoring is built into this product. If inadequate ventilation is provided, overheating may occur. If this condition is detected, the default LCD message will change to OVER TEMP. If this occurs, the problem should be corrected as soon as possible. The unit will remain operational but the ventilation must be restored to prevent premature part failures due to overheating.

STATUS DISPLAYS

When the units are not in the adjust/program mode, status displays are shown. The default display shows the QAM

OUTPUT in Mbits/S. Pressing the down arrow button will show the percentage of buffer capacity that is currently in use on the left side of the display and the maximum percentage of buffer capacity that has occurred since the unit was last programmed is displayed on the right side. Pressing the up arrow button will show the firmware version number.

REMOTE CONTROL AND MONITORING

The MQM6000L may be used with the 'Drake Digital Headend Remote Control Software' program to allow remote monitoring or control. Make sure that the version of the program includes the MQM6000L. Earlier versions will not operate with this unit.

Connect the RS232 cable coming from the PC or modem to the RS232 IN DB9 rear panel connector.

Assign a UNIT ID (1 to 63) to use the remote program. Leave at, or set to, 0 if no remote access is desired.

Set the RS232 BAUD RATE to match the PC setting.

If you are familiar with the program, operation will be clear. If not familiar with it, see further instructions in the insert provided with the CDROM or stored on the CDROM.

TABLE 1: CATV

CABLE TV CHANNELS	
Channel Number	Center of Channel
EIA/NCTA Numeric Equivalent	Frequency in MHz
2	57
3	63
4	69
5	79
6	85
95	93
96	99
97	105
98	111
99	117
14	123
15	129
16	135
17	141
18	147
19	153
20	159
21	165
22	171
7	177
8	183
9	189
10	195
11	201
12	207
13	213
23	219
24	225
25	231
26	237
27	243
28	249
29	255
30	261
31	267
32	273
33	279
34	285
35	291
36	297
37	303
38	309
39	315
40	321

CABLE TV CHANNELS	
Channel Number	Center of Channel
EIA/NCTA Numeric Equivalent	Frequency in MHz
41	327
42	333
43	339
44	345
45	351
46	357
47	363
48	369
49	375
50	381
51	387
52	393
53	399
54	405
55	411
56	417
57	423
58	429
59	435
60	441
61	447
62	453
63	459
64	465
65	471
66	477
67	483
68	489
69	495
70	501
71	507
72	513
73	519
74	525
75	531
76	537
77	543
78	549
79	555
80	561
81	567
82	573
83	579
84	585
85	591

CABLE TV CHANNELS	
Channel Number	Center of Channel
EIA/NCTA Numeric Equivalent	Frequency in MHz
86	597
87	603
88	609
89	615
90	621
91	627
92	633
93	639
94	645
100	651
101	657
102	663
103	669
104	675
105	681
106	687
107	693
108	699
109	705
110	711
111	717
112	723
113	729
114	735
115	741
116	747
117	753
118	759
119	765
120	771
121	777
122	783
123	789
124	795
125	801
126	807
127	813
128	819
129	825
130	831
131	837
132	843
133	849
134	855
135	861

TABLE 2: BC TV

VHF BROADCAST CHANNELS	
<i>Channel Number</i>	<i>Center of Channel Frequency (MHz)</i>
2	57
3	63
4	69
5	79
6	85
7	177
8	183
9	189
10	195
11	201
12	207
13	213

UHF BROADCAST CHANNELS	
<i>Channel Number</i>	<i>Center of Channel Frequency (MHz)</i>
14	473
15	479
16	485
17	491
18	497
19	503
20	509
21	515
22	521
23	527
24	533
25	539
26	545
27	551
28	557
29	563
30	569
31	575
32	581
33	587
34	593
35	599
36	605
37	611
38	617
39	623
40	629
41	635
42	641
43	647
44	653
45	659
46	665
47	671
48	677
49	683
50	689
51	695
52	701
53	707
54	713
55	719
56	725
57	731
58	737
59	743
60	749
61	755
62	761
63	767
64	773
65	779
66	785
67	791
68	797
69	803

SERVICE INFORMATION

You may contact the R.L. DRAKE Service Department for additional information or assistance by calling +1 (937) 746-6990, Monday through Friday, between 8:00 A.M. and 4:00 P.M. Eastern Time, except on holidays.

You may also contact the R.L. DRAKE Service Department by E-mail at the following address:
TechSupport@rldrake.com
or by Telefax:
+1 (937) 806-1576.

Should you want to return your unit for service, package the unit carefully using the original carton or other suitable container.

Write your return address clearly on the shipping carton and on an enclosed cover letter describing the service required, symptoms or problems. Also include your daytime telephone number and a copy of your proof of purchase.

The unit will be serviced under the terms of the R.L. DRAKE LLC Limited Warranty and returned to you.

IF YOU NEED TO CALL FOR HELP

Call our Customer Service/Technical Support line at +1 (937) 746-6990 between 8:00 A.M. and 4:00 P.M. Eastern Time, weekdays. Please have the unit's serial number available. We will also need to know the specifics of any other equipment connected to the unit. When calling, please have the unit up and running, near the phone if possible. Our technician(s) will likely ask certain questions to aid in diagnosis of the problem. Also, have a voltmeter handy, if possible.

R.L. DRAKE also provides technical assistance by e-mail: TechSupport@rldrake.com
or by Telefax: +1 (937) 806-1576.

Many of the products that are sent to us for repair are in perfect working order when we receive them. For these units, there is a standard checkout fee that you will be charged. Please perform whatever steps are applicable from the installation sections of the Owner's Manual before calling or writing—this could save unnecessary phone charges. Please do not return the unit without contacting R.L. DRAKE first: it is preferred to help troubleshoot the problem over the phone (or by mail) first, saving you both time and money.

Inside the carton, enclose a note with your name, address, daytime phone number, and a description of the unit's problem.

The unit must be sent to the following address:

**Service Department
R.L. DRAKE LLC
230 Industrial Drive
Franklin, Ohio 45005 U.S.A.**

Be sure to include your street address which will be needed for UPS return. UPS Surface (Brown Label) takes 7-10 days to reach us depending on your location, Blue takes 2-3 days.

Red is an overnight service. Send the unit in a way that it can be traced if we can't verify receipt of shipment. We suggest UPS or insured postal shipment.

If the unit is still under the original owner's warranty, R.L. DRAKE will pay the cost of the return shipment to you. Our return shipping policy is that we will return it UPS Brown if received Brown or by US Mail, it will be returned Blue if received Blue or Red—or it will be returned however you prefer if you furnish the return cost for the method you select.

If the unit is out of warranty, use one of the following methods for return shipment:

- 1) You designate billing to American Express, VISA, MasterCard or Discover card;
- 2) You prepay the service charges with a personal check, or
- 3) You specify some other method of return and payment.

When calling, the technician can estimate the repair charges for you over the phone. This is another good reason to call before sending a unit in for repair. Typically, equipment is repaired in five to ten working days after it arrives at R.L. DRAKE if we have all the facts. If we must call you, it may take longer. R.L. DRAKE is not responsible for damage caused by lightning, nonprofessional alterations, "acts of God", shipping damage, poor storage/handling, etc. R.L. DRAKE will make note of any shipping damage upon receipt.

You will need to send proof of purchase to receive warranty service. Typically, a copy of the invoice from an R.L. DRAKE dealer will suffice. The warranty is for the original owner only and is not transferable.

14 Warranty

Three Year Limited Warranty

R.L. DRAKE LLC warrants to the original purchaser this product shall be free from defects in material or workmanship for three (3) years from the date of original purchase.

During the warranty period the R.L. DRAKE LLC or an authorized Drake service facility will provide, free of charge, both parts and labor necessary to correct defects in material and workmanship. At its option, R.L. DRAKE LLC may replace a defective unit.

To obtain such a warranty service, the original purchaser must:

- (1) Retain invoice or original proof of purchase to establish the start of the warranty period.
- (2) Notify the R.L. DRAKE LLC or the nearest authorized service facility, as soon as possible after discovery of a possible defect, of:
 - (a) the model and serial number,
 - (b) the identity of the seller and the approximate date of purchase; and
 - (c) A detailed description of the problem, including details on the electrical connection to associated equipment and the list of such equipment.
- (3) Deliver the product to the R.L. DRAKE LLC or the nearest authorized service facility, or ship the same in its original container or equivalent, fully insured and shipping charges prepaid.

Correct maintenance, repair, and use are important to obtain proper performance from this product. Therefore carefully read the Instruction Manual. This warranty does not apply to any defect that R.L. DRAKE LLC determines is due to:

- (1) Improper maintenance or repair, including the installation of parts or accessories that do not conform to the quality and specifications of the original parts.
- (2) Misuse, abuse, neglect or improper installation.
- (3) Accidental or intentional damage.

All implied warranties, if any, including warranties of merchantability and fitness for a particular purpose, terminate three (3) years from the date of the original purchase.

The foregoing constitutes R.L. DRAKE LLC'S entire obligation with respect to this product, and the original purchaser shall have no other remedy and no claim for incidental or consequential damages, losses or expenses. Some states do not allow limitations on how long an implied warranty lasts or do not allow the exclusions or limitation of incidental or consequential damages, so the above limitation and exclusion may not apply to you.

This warranty gives you specific legal rights and you may also have other rights which vary from state to state. This warranty shall be construed under the laws of Ohio.

For Service, contact:

R.L. DRAKE LLC
230 Industrial Drive
Franklin, Ohio 45005 U.S.A.
Customer Service and Parts Telephone: +1 (937) 746-6990
Telefax: +1 (937) 806-1576
World Wide Web Site: <http://www.rldrake.com>



R.L. Drake LLC

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